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RETURN TUBULAR BOILERS

ESTABLISHED 1864

E. KEELER COMPANY

WILLIAMSPORT, PA.

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RETURN TUBULAR BOILERS

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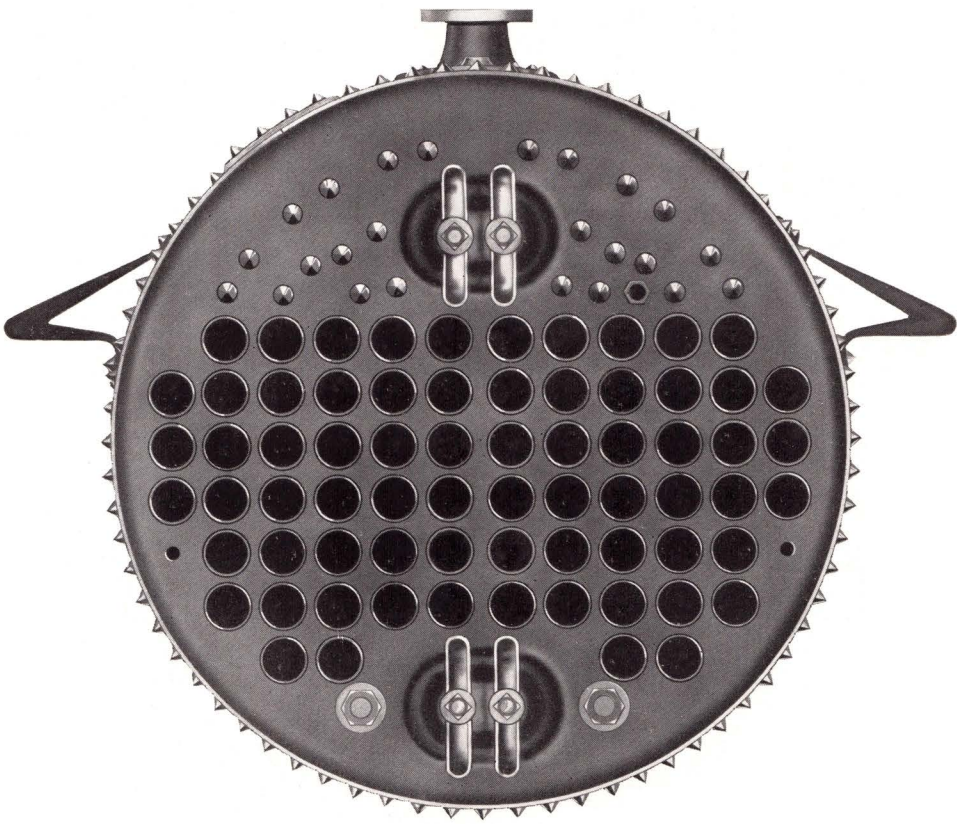

E. KEELER COMPANY

WILLIAMSPORT, PA.

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BOSTON
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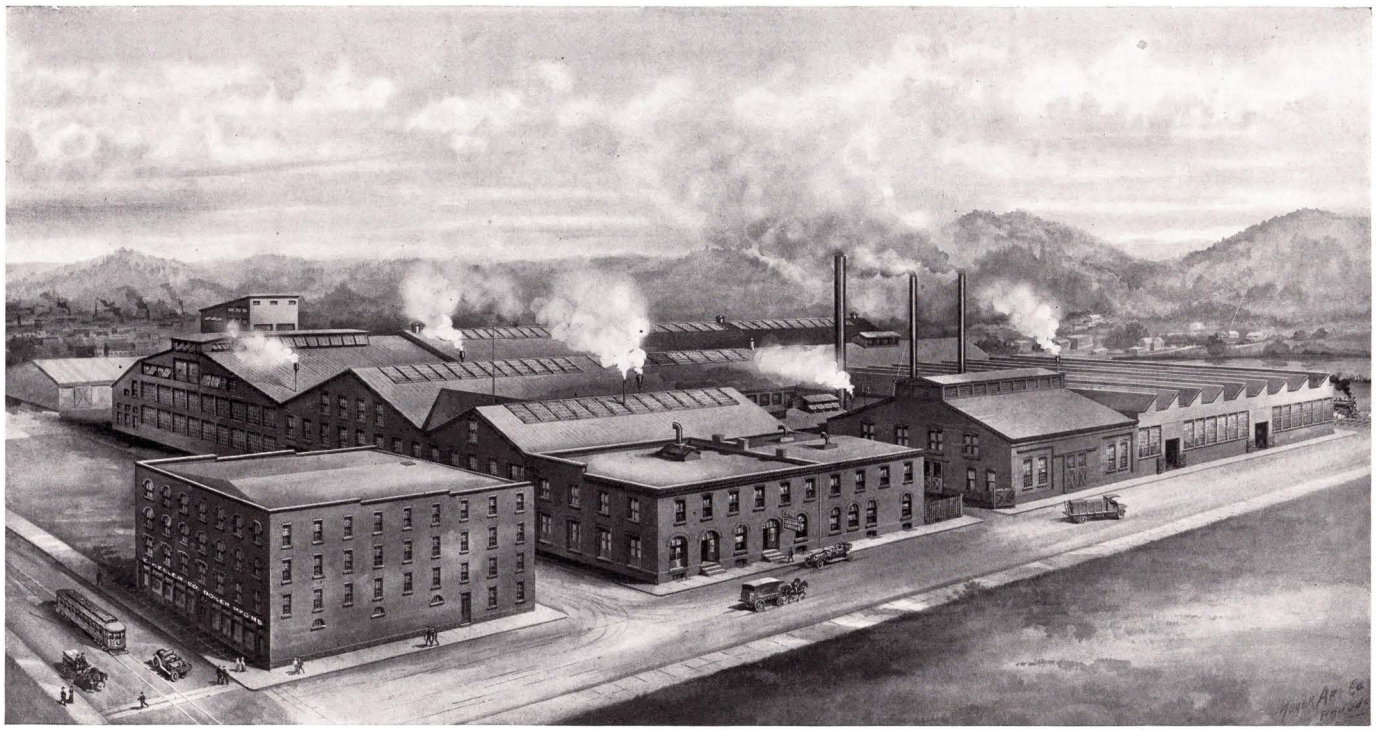

E. KEELER COMPANY SHOPS, WILLIAMSPORT, PA.

INTRODUCTORY

KEELER BOILERS are offered to steam users as the product of over three score years experience in building boilers. The E. Keeler Shops have been in continual operation building boilers since established in 1864.

KEELER *quality* is the result of a constant effort to place KEELER BOILERS among steam users who require the best that can be produced.

We have the experience, proven workmanship, design, the tools and machinery required to produce the best.

KEELER *equipment* has kept pace with the latest developments in machinery and tools. The Keeler plant is equipped only with tools and machines that have proven best for performing the various operations in the most scientific manner. Thus eliminating inaccuracies associated with the use of badly worn or obsolete machinery and tools. Illustrations of some of the equipment of the Keeler shops are shown in the latter part of this catalog.

The extreme care used in the building of KEELER BOILERS can only be appreciated by a visit to our shop or by an inspection of the completed work.

All KEELER BOILERS are built in strict conformity with the A. S. M. E. Boiler Code.

E. KEELER COMPANY,
Williamsport, Pa.

FACTS ON CIRCULATION

Considerable controversy had taken place, prior to 1922, concerning the water action (circulation) within the Horizontal Return Tubular Boiler. To verify the opinions held by engineers throughout this country a National Contest was conducted and fifty-four engineers' associations submitted their opinion as to what this action is. The Judges* of the contest were provided with a working boiler model built by the E. Keeler Company, for their use in making their study. After considerable time spent in studying the operation of this boiler, using a strong microscopic glass to trace small objects placed in the water, it was observed that there IS a pronounced and definite water circulation within this type of boiler.

The result of the study is as follows: The water travel is in the form of a figure eight (∞) in a horizontal position. Starting at a line approximately at the bridge wall the flow of the water is along the bottom of the shell toward the front boiler head where it is deflected upward above the normal or cold water level, then rearward to approximately two-thirds of the length of the boiler where the flow dropped downward to the shell, along the bottom of the shell to the rear head, where it was again directed upward to slightly above the normal water line where it turned, forming the small loop of the figure eight and dropped down to the place of beginning.

There have been several other controversies regarding the construction of this, the oldest type of boiler in common use today. Some have argued that the tubes should be placed in groups; others have suggested that they be in staggered vertical rows. To place the tubes in staggered vertical rows or in group formations it is possible to install a larger number, but by so doing it is difficult to clean any scale or scale forming deposits from their outside surface, a duty which is disagreeable under the best conditions. This grouping formation also restricts the circulation of the water. It is an indisputable fact that a clean boiler and one in which the circulation is pronounced is more economical and will have a longer life than a boiler which does not permit every facility for cleaning and unobstructed circulation.

An excessive number of tubes placed in a Return Tubular Boiler cuts down the available space for steam storage, reduces the velocity and effectiveness of the gases, products of combustion.

The tube arrangements in Keeler Return Tubular Boilers facilitates maintenance and efficient operation.

Due to the greater thickness in shell plates required, the E. Keeler Company does not recommend a Horizontal Return Tubular Boiler in excess of 84 inches in diameter.

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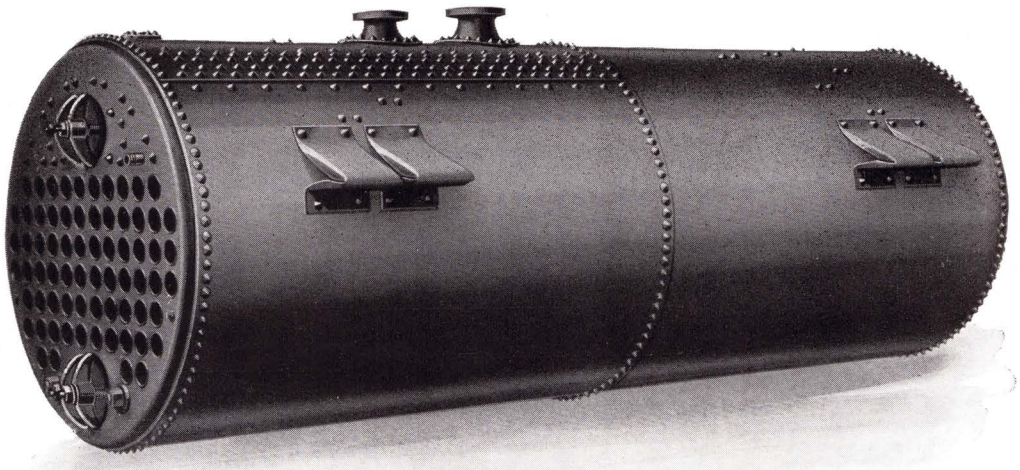
* *F. R. Low, Editor of "Power," and John Lane, Editor of "National Engineer," were the judges of the contest.*



The Keeler Return Tubular Boiler

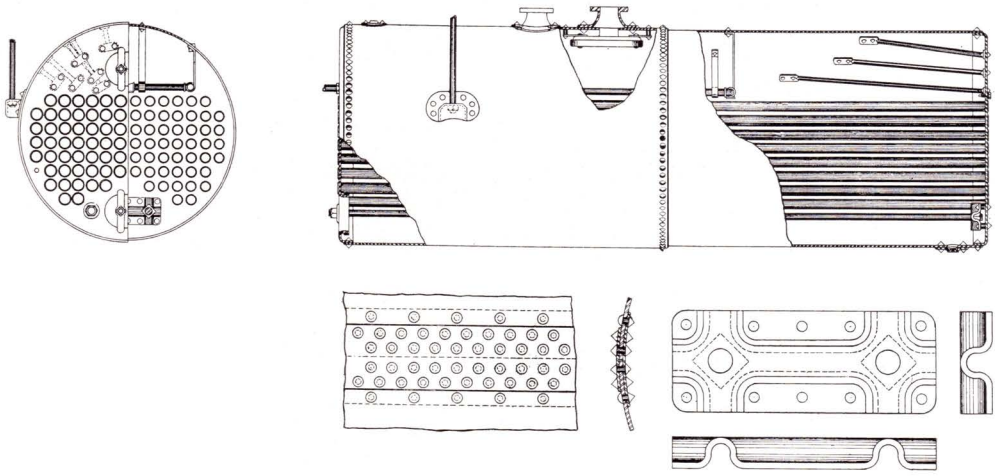
Believing that the Return Tubular Boiler occupies a field of its own where it is undoubtedly as good a boiler for the purpose in view as can be selected, we have made an effort to bring the design of this boiler to the highest degree of perfection. The features of the boiler illustrated and described as our standard have been adopted for the purpose of securing dependability and eliminating weaknesses and defects.

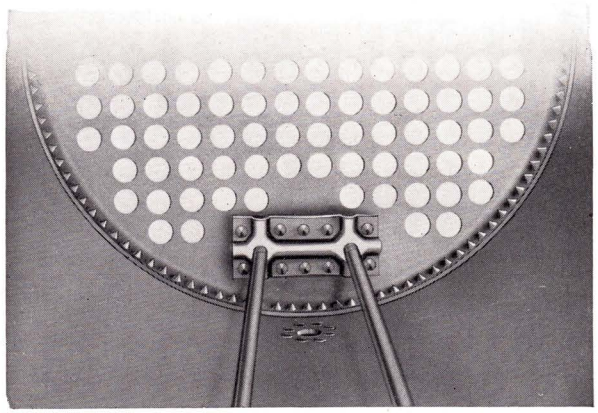
Keeler Tubular Boilers are built in two or three courses. When two courses are used the front course overlaps the rear course. When three courses are used the end courses overlap the center course. This construction avoids the unequal internal strains inseparable from the long riveted seams, which are a feature of a boiler built with bottom half in a single sheet. In the last few years the accidents to such boilers have shown the single bottom sheet boiler to be a dangerous experiment.

The front head is flanged inwardly. This construction is more expensive than the design which provides for backing the front head in with the front sheet extended to form a smoke box. The disadvantages of the latter construction are:

Corrosion of rivets, head and extended sheet, opportunity for leaks at both ends of the rivet, danger of burning rivets unprotected by water in case the protecting brickwork should fall away.

The trimmings, such as manhole plates, yokes and brackets, are of pressed steel. Besides being stronger than cast iron, they are of known quality. Cast iron is unsatisfactory for pressure parts. It frequently has sand or air holes which cannot be detected by surface inspection.





All power boilers are provided with through braces extending from head to head under the tubes.

These braces are designed in such a way that it is not necessary to upset the end of the brace. The braces are secured to the rear boiler head by a special patented arrangement. This connecting attachment is pressed from a solid piece of boiler plate. The design is such that it is stronger than a combination of angles or channels, and it has less surface to gather scale than any other design for the attachment of the through brace to the head. With this design provision has been made for the renewal of the through braces.

The attaching of the through rods to the rear head with this patented connecting plate allows for the unequal contraction of the rods and shell and prevents the bending or distortion of the rods so they lose their effectiveness.

All plates are full thickness on the edge and are not ordered to weight. This adds extra weight to the boiler shell and consequently increases the price. For instance, plate ordered 7-16 inch thick weighs 19 pounds per square foot, while plate ordered to weight weighs 17.86 pounds per square foot and on a 72 in. x 18 ft. Tubular Boiler this extra weight is 400 pounds.

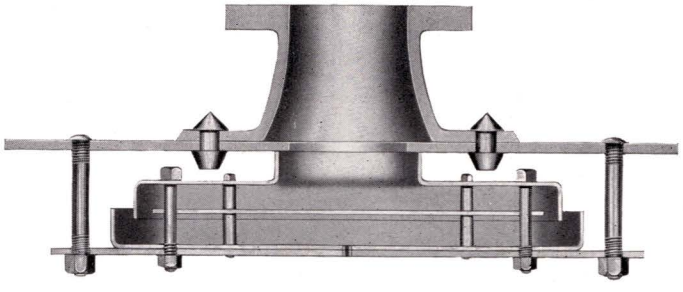
Steam domes are a source of weakness and are not recommended.

Boilers are supported by means of pressed steel wall brackets resting on suitable wall plates, or suspended from steel girders resting on steel "I" beam columns. The brackets are pressed from open hearth steel plate, and are of an unusually strong and rigid design.

All Keeler Tubular Boilers are built with butt strap longitudinal seams, which are double, triple or quadruple riveted as required by size and pressure. No boiler of lap riveted construction should be considered for power purposes. The small saving in the cost of the bare boiler is not justified when compared with the total cost of boiler and fixtures installed, as such boilers are soon refused by insurance companies except at pressures too low for the requirements of economy.

The feed water is introduced into the boiler in such a manner that the water is not discharged directly against the surfaces exposed to gases of high temperature.

The feed pipe is carried through the front head in manner specified by the A. S. M. E. Code, and an internal feed pipe is provided three-fifths of the length of the boiler. This pipe is rigidly supported by substantial wrought iron braces.



An Internal Separator is placed at the steam outlet to prevent entrainment and insure dry steam.

Steam and Safety Valve outlets are provided with forged steel nozzles.

The M a n h o l e s, usually placed in the front head above and below the tubes, are internally flanged and reinforced with a stiffening ring shrunk on and secured by means of dowel pins. The ring and flange are planed off together, thus affording a bearing surface for a gasket at least an inch wide. When one manhole is located in the shell, a heavy, double riveted, internally flanged steel saddle is used. The manhole plate is of heavy pressed steel, with two bolts permanently riveted in place. These plates are lighter and easier to handle than cast iron plates with separate bolts, and they do not break.

During the past few years there has been, a constantly increasing attention, paid to the details of boiler design and workmanship by the manufacturers, the insurance companies, and the general public represented by State Legislatures. The policy of the E. Keeler Company has always been to maintain a standard of workmanship and material second to none that could be offered.

Many of the provisions of the Ohio and Massachusetts laws were standard practice with us before such methods became mandatory in those states.

All materials entering into the construction of Keeler Boilers are in accordance with the requirements of the American Society of Mechanical Engineers.

All boilers are laid out by hand, thus insuring careful scrutiny of each plate used and avoiding the inaccurate work of the majority of rack punches.

All heads for tubular boilers are flanged on a spinning machine. This machine turns a flange perfectly square with the face of the head and entirely free from buckling and against which the shell of the boiler can be laid up snugly. When the shell is caulked against such a flange the material is already in close contact and the caulking remains tight. The ends of the butt straps are all machined.

All tube holes are drilled from the solid and internal strains, in the head due to punching the tube holes only slightly smaller than the finished hole and then reaming to size, are avoided. The outside edge of the hole is chamfered and in addition the bur is removed from the inside edge.

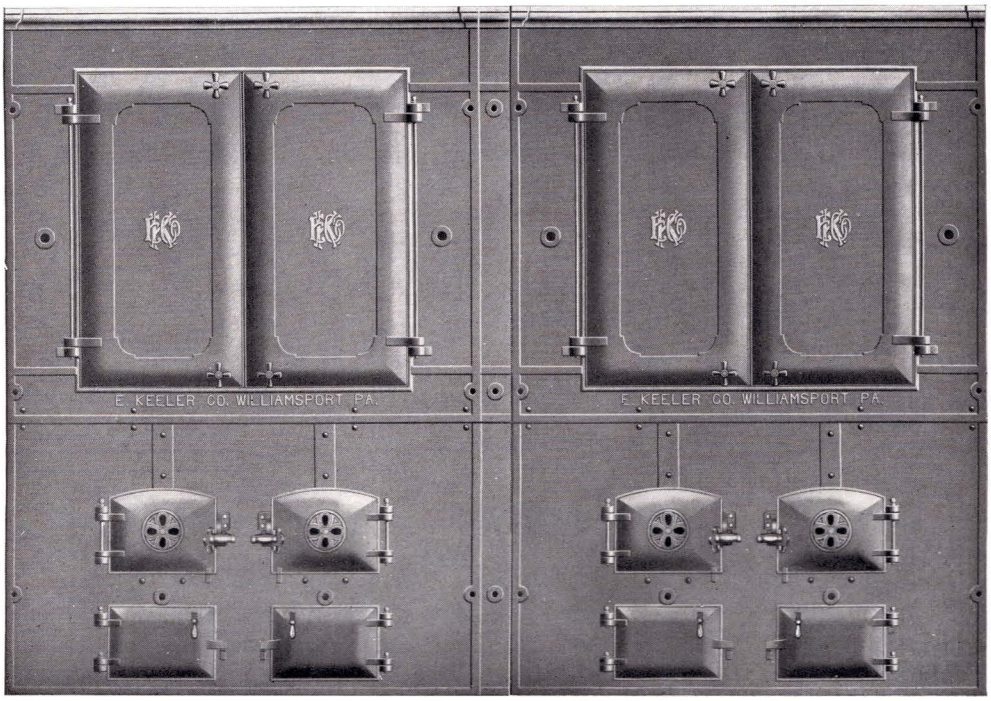
All holes for rivets are made smaller than required and after the plates are assembled are reamed to size. Every rivet hole is perfectly clean and perfectly in line before rivets are driven. All burs are removed before riveting. Rivets are driven, wherever possible, by heavy hydraulic pressure and held until shrinkage takes place. All other rivets are driven by pneumatic hammers. Rivets are of our own special design which we have been using with uniform success for many years. The perfect alignment and dependability of Keeler riveting is evidence of the success of this detail. All details of heating and driving of the rivets, expanding and beading tubes are done by men trained to perform the work in one way, and that the best.

Boiler braces are drop forged without welds, are round in sections and consequently interfere as little as possible with access to the interior of the boiler and afford the least surface for accumulation of scale.

All boilers are tested to a hydrostatic pressure 50 per cent greater than working pressure.

Boilers are guaranteed to pass the inspection of any established boiler inspection and insurance company for the pressure specified.

The proof of the superiority of Keeler workmanship lies in the wonderful record which our product has made for itself during the past sixty-four years.

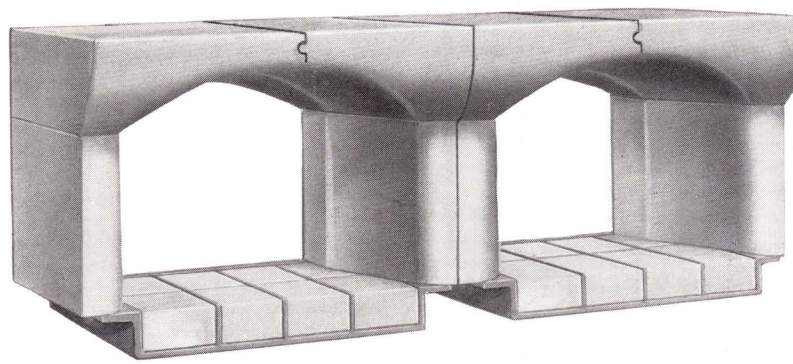


STANDARD FULL FLUSH FRONT FOR BATTERY

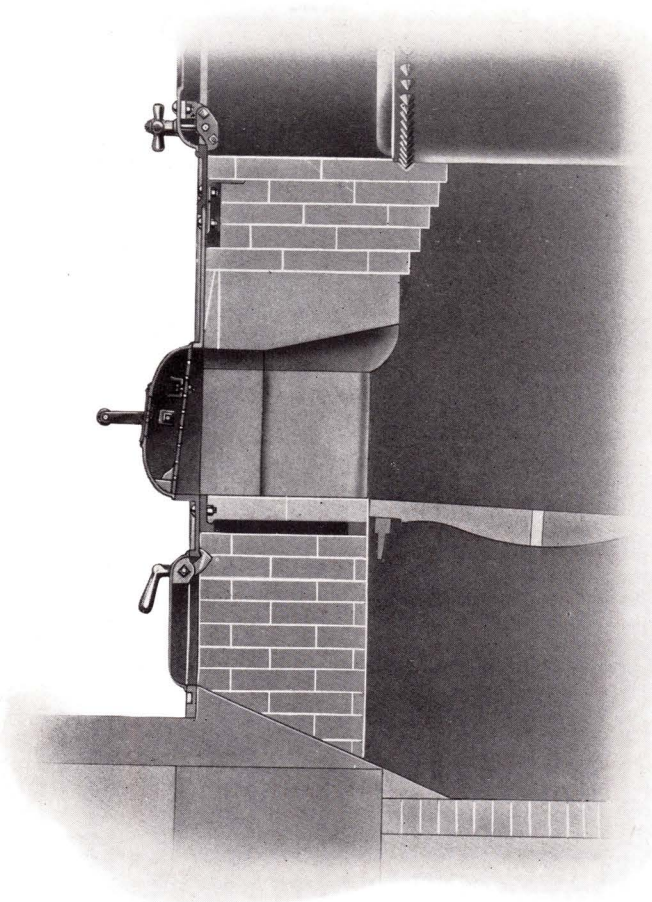
The Keeler Full Flush Front is of heavy, substantial design. All doors have a deep flange or roll. This feature prevents warping and cracking of edges, and gives the front a rich and handsome appearance. Fire doors are of an extra heavy, deep pattern, with a liberal air space between the door and the perforated liner, which preserves both castings. Fire doors close against inclined seats, so that they never hang away from the front. Provision is made for expansion above the fire doors, which absolutely prevents cracks at the corners of the openings under all ordinary conditions of service. All doors and seats are carefully fitted to a close bearing, and all fronts are assembled complete before shipment. The top of the front is furnished with a handsome cornice.

The tube door latch is provided with a threaded handle turning on a tee headed bolt. When the handle is revolved the bolt draws the latch against the inside of the front. This latch is so powerful in its action as to entirely prevent the tube door from warping and standing away from its seat with consequent loss of draft and efficiency.

The oval stack base is a heavy casting strongly ribbed, and unless otherwise specified will be arranged to rest on the front end of the setting.



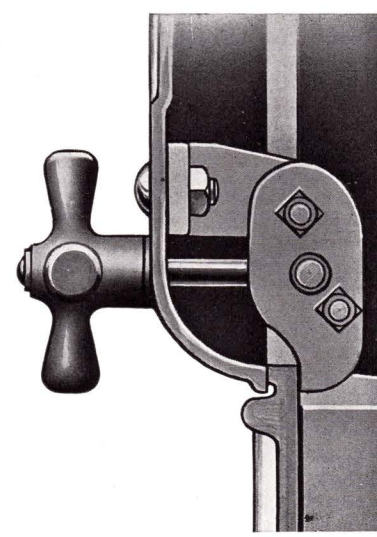
FIRE DOOR ARCHES AND DEAD PLATES—REAR VIEW



SECTION THROUGH LOWER HALF OF FRONT SHOWING FIRE DOOR, FIRE DOOR LINER, DEAD PLATE LINED WITH FIRE BRICK, FIRE DOOR ARCH AND JAMB

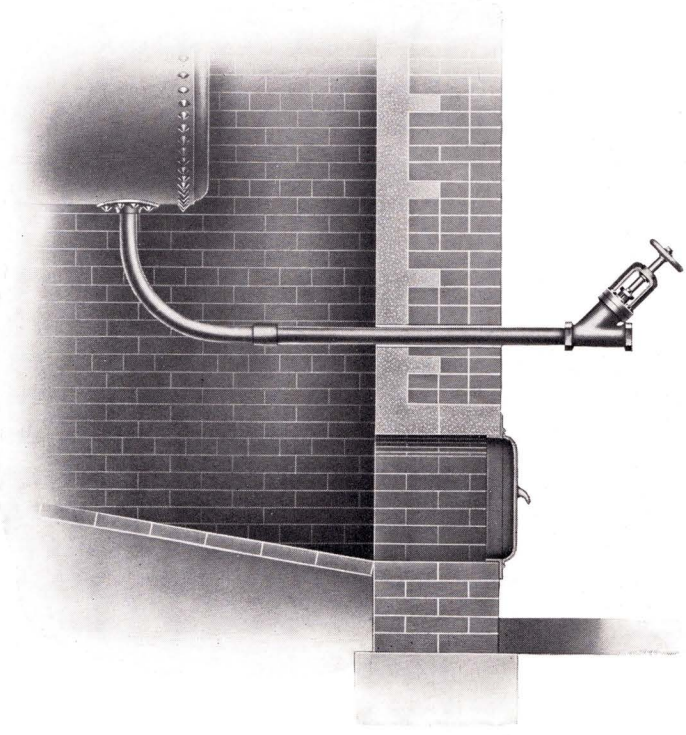
Fire door arches and jambs are blocks of hard burned fire clay of the most refractory mixture. Both jambs and arches are flared to facilitate spreading the coal. They save money on the first cost of the brick setting and future repairs.

Dead plates are of a special design, arranged for fire brick lining. This keeps the fire away from the dead plate and prevents it from burning. Ribs alternate with the brick and prevent excessive wear.



DETAIL OF TUBE DOOR LATCH

As a part of our Standard Tubular Boiler Equipment, we include an extra heavy long radius steel blow-off bend and extra heavy pipe to bring the blow-off outside the boiler setting. The design of the bend is such that dirt and scale cannot lodge in it; consequently it cannot easily burn. It will not crack. Cast iron elbows used for this purpose break.



SECTION THROUGH REAR WALL SHOWING PRESSED STEEL BLOW OFF FLANGE, BLOW OFF BEND, VALVE AND REAR DUST DOOR

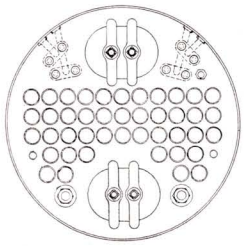
Boilers fourteen feet long and over are provided with six side and two rear buckstays of rolled steel. The buckstay rods extend all the way across the setting and the tie rods the entire length of the setting.

Each buskstay consists of two channels placed back to back and retained in position by a special clamp washer. The tie or cross rods pass between the channels.

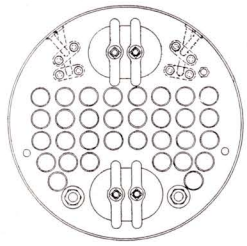
The fronts are tied to rear buckstays by means of three rods in each side wall. Cracks in setting walls sometimes follow an attempt to make the price "attractive" by reducing the number of side buckstays and omitting through rods and rear buckstays.

Grate bars over 48 in. long are in two sections with heavy center bearing bar.

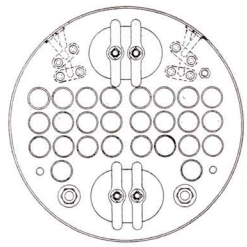
Grates are provided with separate bearing bars for front and rear. The bearing bar at the front end is independent of dead plates. A dead plate with a lip cast on it for the support of the grates is apt to warp and allow the grates to fall. Also ashes accumulate and displace the grates. Shaking grates can be furnished for an additional sum and warrant the added investment.



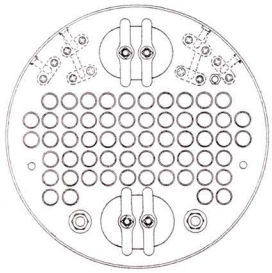
48" DIAM BOILER
43-3" TUBES



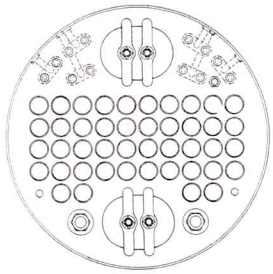
48" DIAM BOILER
32-3½" TUBES



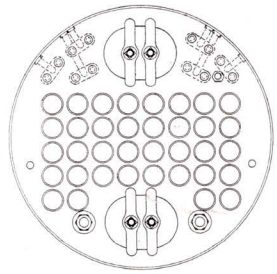
48" DIAM BOILER
26-4" TUBES



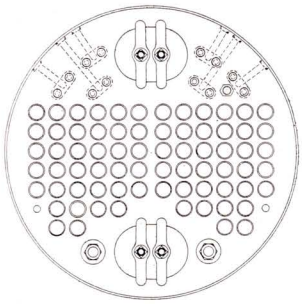
54" DIAM BOILER
58-3" TUBES



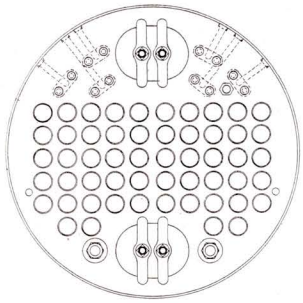
54" DIAM BOILER
44-3½" TUBES



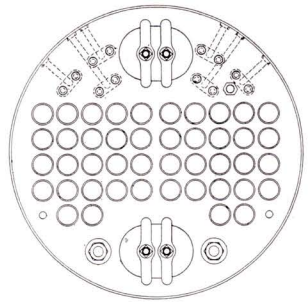
54" DIAM BOILER
36-4" TUBES



60" DIAM BOILER
72-3" TUBES



60" DIAM BOILER
54-3½" TUBES

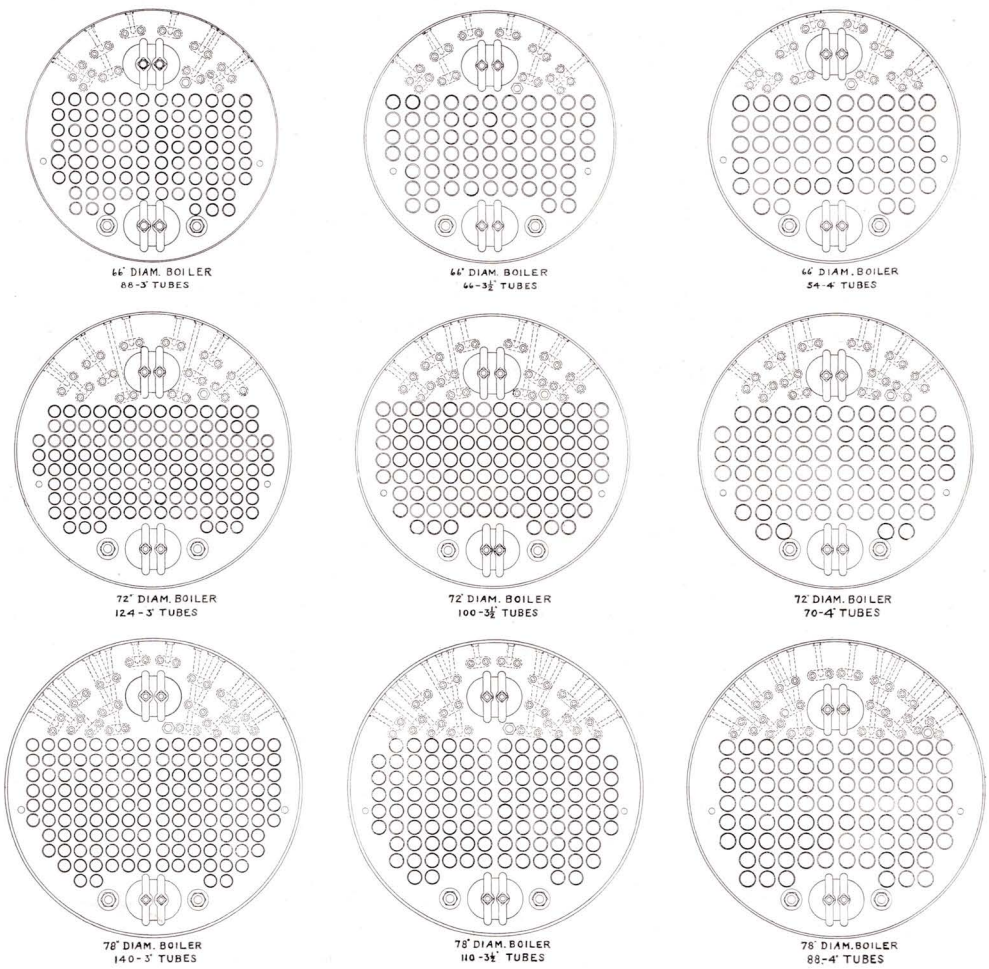


60" DIAM BOILER
44-4" TUBES

SUGGESTED FRONT HEAD LAY-OUT RETURN TUBULAR BOILERS
SIZES 48", 54" AND 60" DIAMETER

Showing tube spacing for various size tubes, arrangement of bracing, and location feed and water column connections.

Boilers will be built with more or less tubes or arranged in different manner to meet special specifications.

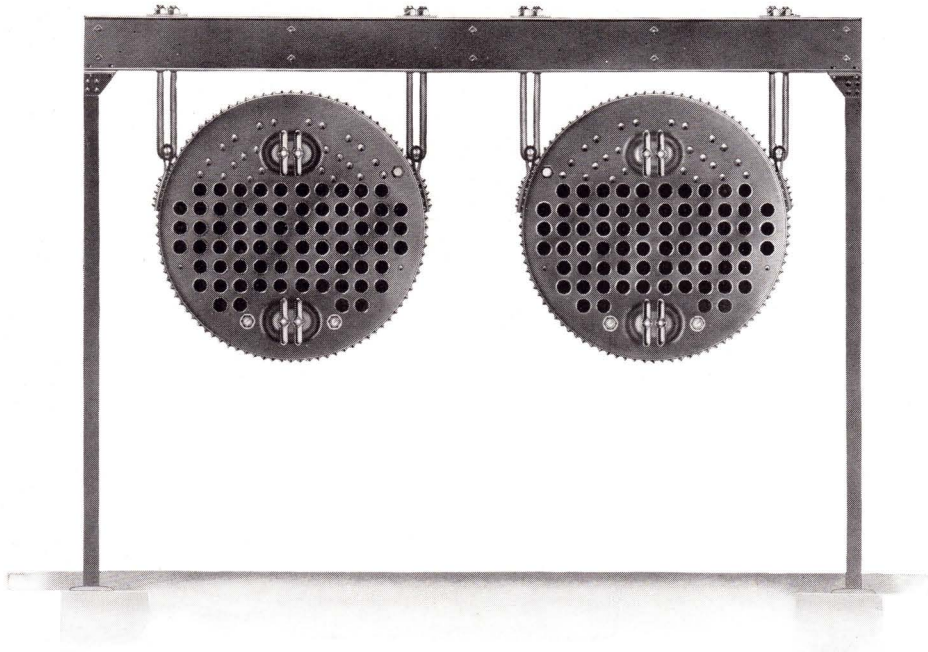


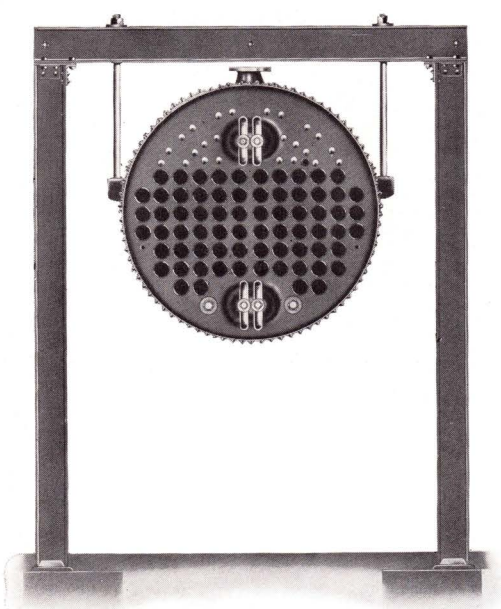
SUGGESTED FRONT HEAD LAY-OUT RETURN TUBULAR BOILERS
SIZES 66", 72" and 78" DIAMETER

Tubes are spaced to facilitate cleaning and to provide freedom of water circulation.

Keeler Boilers are built to Keeler Standard Specifications unless otherwise requested.

STRUCTURAL STEEL SUPPORTS





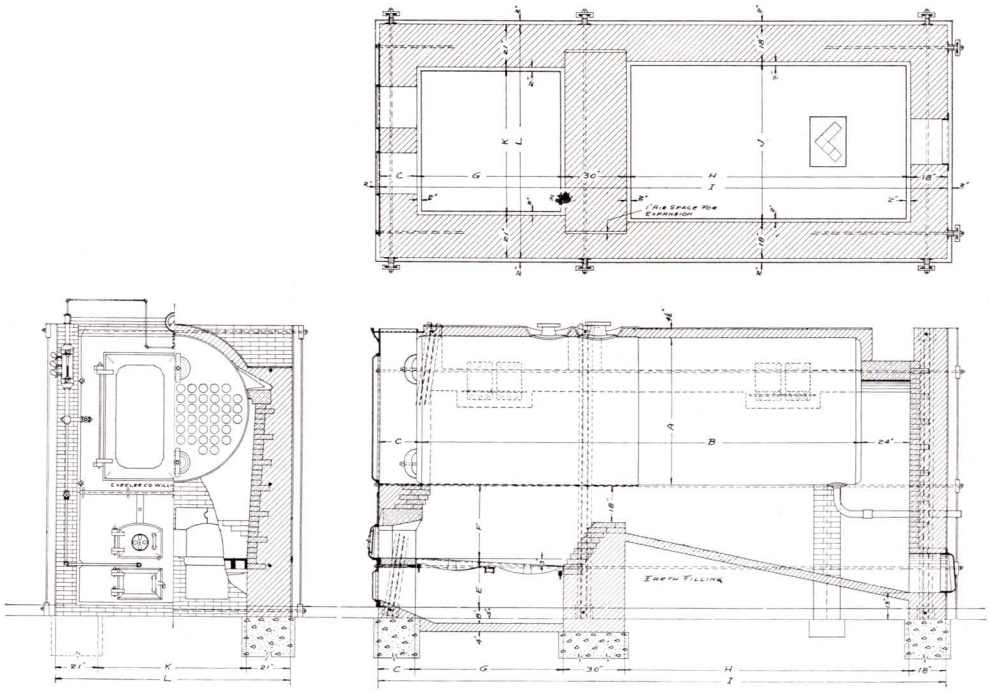
Special structural steel supporting frame for two boilers in battery without column in center wall, used principally with stoker or Dutch Oven Settings. Plate loops riveted to boiler with pins and "U" bolts used on boilers 78 in. diameter and over.

Standard supporting frame with columns for each wall.

Pressed steel hanger riveted to boiler with straight bolt used on boiler 72 in. diameter and under.

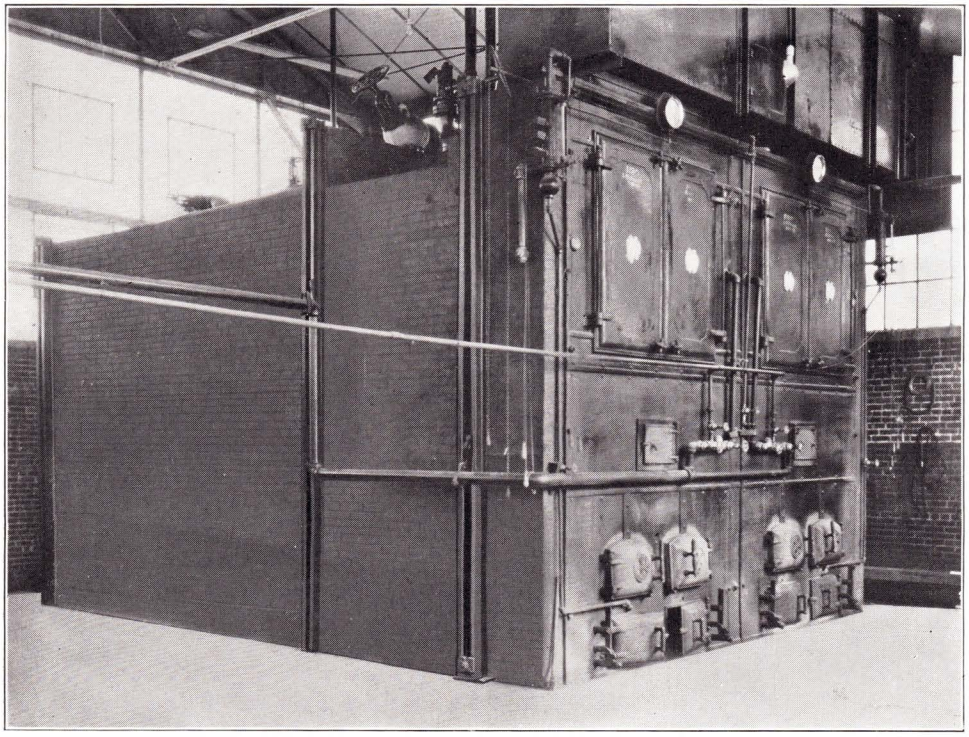
Structural steel supports are only furnished when specified and at an increased price.

Setting Dimensions Horizontal Return Tubular Boilers

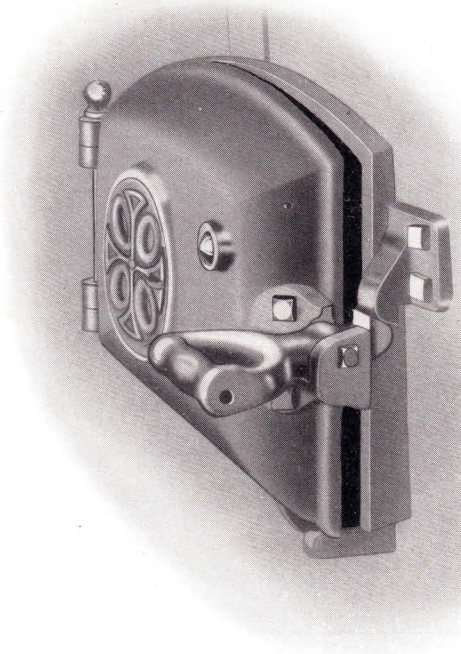


HORSE POWER	15	20	25	30	35	40	45	50	60	70	75
A—Diameter of Boiler	36	36	36	44	44	44	48	48	54	54	60
B—Length of Boiler	8	10	12	10	12	14	12	14	14	16	14
C—Front Wall	13	13	13	17	17	17	17	17	18	18	18
D—Floor to Stack Plate	7′ 2½″	7′ 2½″	7′ 2½″	8′ 2¾″	8′ 2¾″	8′ 2¾″	8′ 11½″	8′ 11½″	9′ 9¾″	9′ 9¾″	10′ 2″
E—Floor to Dead Plate	24	24	24	24	24	24	24	24	24	24	24
F—Grates to Boiler	28	28	28	28	28	28	28	28	36	36	36
G—Length of Ash Pit	36	36	42	42	42	48	48	48	48	54	54
H—Combustion Chamber	4′ 6″	6′ 6″	8′ 0″	6′ 0″	8′ 0″	9′ 6″	7′ 6″	9′ 6″	9′ 6″	11′ 6″	9′ 0″
I—Length Over All	12′ 7″	14′ 7″	16′ 7″	14′ 11″	16′ 11″	18′ 11″	16′ 11″	18′ 11″	19′ 0″	21′ 0″	19′ 0″
J—Width Comb. Chamber	42	42	42	50	50	50	54	54	60	60	66
K—Width of Furnace	36	36	36	44	44	44	48	48	54	54	60
L—Width Over All	6′ 6″	6′ 6″	6′ 6″	7′ 2″	7′ 2″	7′ 2″	7′ 6″	7′ 6″	8′ 0″	8′ 0″	8′ 6″
No. of Fire Brick Single	725	800	960	1000	1100	1200	1284	1500	1800	2080	1940
No. of Red Brick Single	6000	6800	7600	7300	8760	10200	9300	10800	11200	12800	12200
No. of Fire Brick for Battery	1450	1600	1920	2000	2200	2400	2568	3000	3600	4160	3880
No. of Red Brick for Battery	8200	11500	12800	12100	14680	17200	15375	18000	18400	21200	20400

HORSE POWER	80	90	100	115	125	150	175	175	200	200	225
A—Diameter of Boiler	60	60	66	66	72	72	72	78	78	84	84
B—Length of Boiler	16	18	16	18	16	18	20	18	20	18	20
C—Front Wall	18	18	18	18	18	18	18	18	18	18	18
D—Floor to Stack Plate	10′ 2″	10′ 2″	10′ 8″	10′ 8″	11′ 2″	11′ 2″	11′ 2″	11′ 7″	11′ 7″	12′ 1″	12′ 1″
E—Floor to Dead Plate	24	24	24	24	24	24	24	24	24	24	24
F—Grates to Boiler	36	36	36	36	36	36	36	36	36	36	36
G—Length of Ash Pit	54	60	60	66	66	72	78	72	78	72	78
H—Combustion Chamber	11′ 0″	12′ 6″	10′ 6″	12′ 0″	10′ 0″	11′ 6″	13′ 0″	11′ 6″	13′ 0″	11′ 6″	13′ 0″
I—Length Over All	21′ 0″	23′ 0″	21′ 0″	23′ 0″	21′ 0″	23′ 0″	25′ 0″	23′ 0″	25′ 0″	23′ 0″	25′ 0″
J—Width Comb. Chamber	66	66	72	72	78	78	78	84	84	90	90
K—Width of Furnace	60	60	66	66	72	72	72	78	78	84	84
L—Width Over All	8′ 6″	8′ 6″	9′ 0″	9′ 0″	9′ 6″	9′ 6″	9′ 6″	10′ 0″	10′ 0″	10′ 6″	10′ 6″
No. of Fire Brick Single	2330	2435	2350	2540	2650	2980	3300	3020	3360	3400	3780
No. of Red Brick Single	13000	14400	13800	15000	14800	15600	16700	16400	18500	18000	20000
No. of Fire Brick for Battery	4460	4870	4700	5080	5300	5960	6600	6040	6720	6800	7560
No. of Red Brick for Battery	21600	23970	22700	24687	24700	25900	27600	27235	30950	30200	33700



CROOKS-DITTMAR CO., WILLIAMSPORT, PA.
TWO 78" x 18' HORIZONTAL RETURN TUBULAR SET 8'-0" FLOOR LEVEL TO UNDERSIDE BOILER SHELL



FIRE DOOR WITH AUTOMATIC LOCK

The Code Follows:

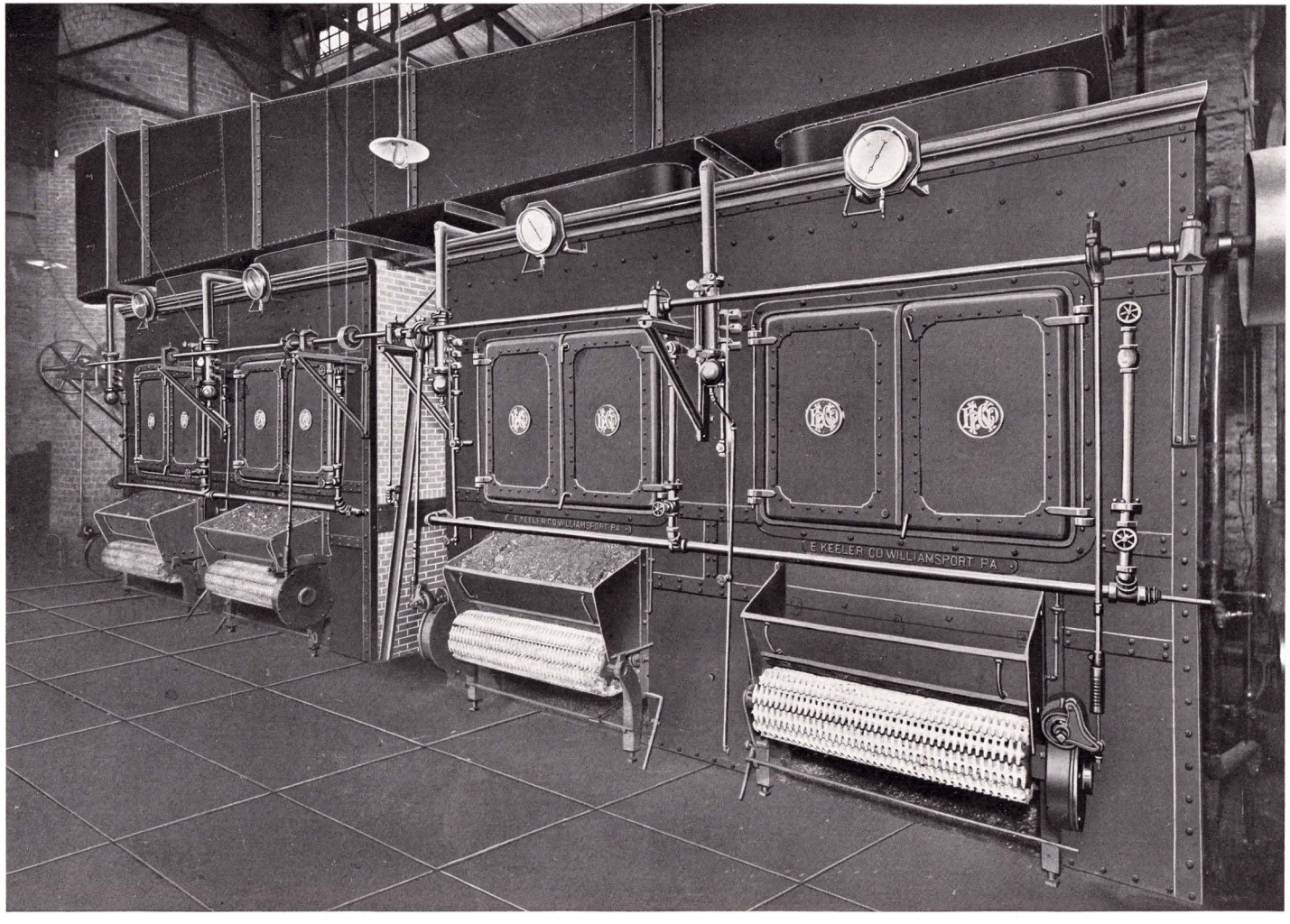
Keeler ingenuity in developing safety devices has a foremost place in the records of engineering achievement. Many Keeler developments have preceded A. S. M. E. Code requirements.

The Automatically Locking Fire Door device has met with approval and commendation of safety engineers and State Inspection Authorities.

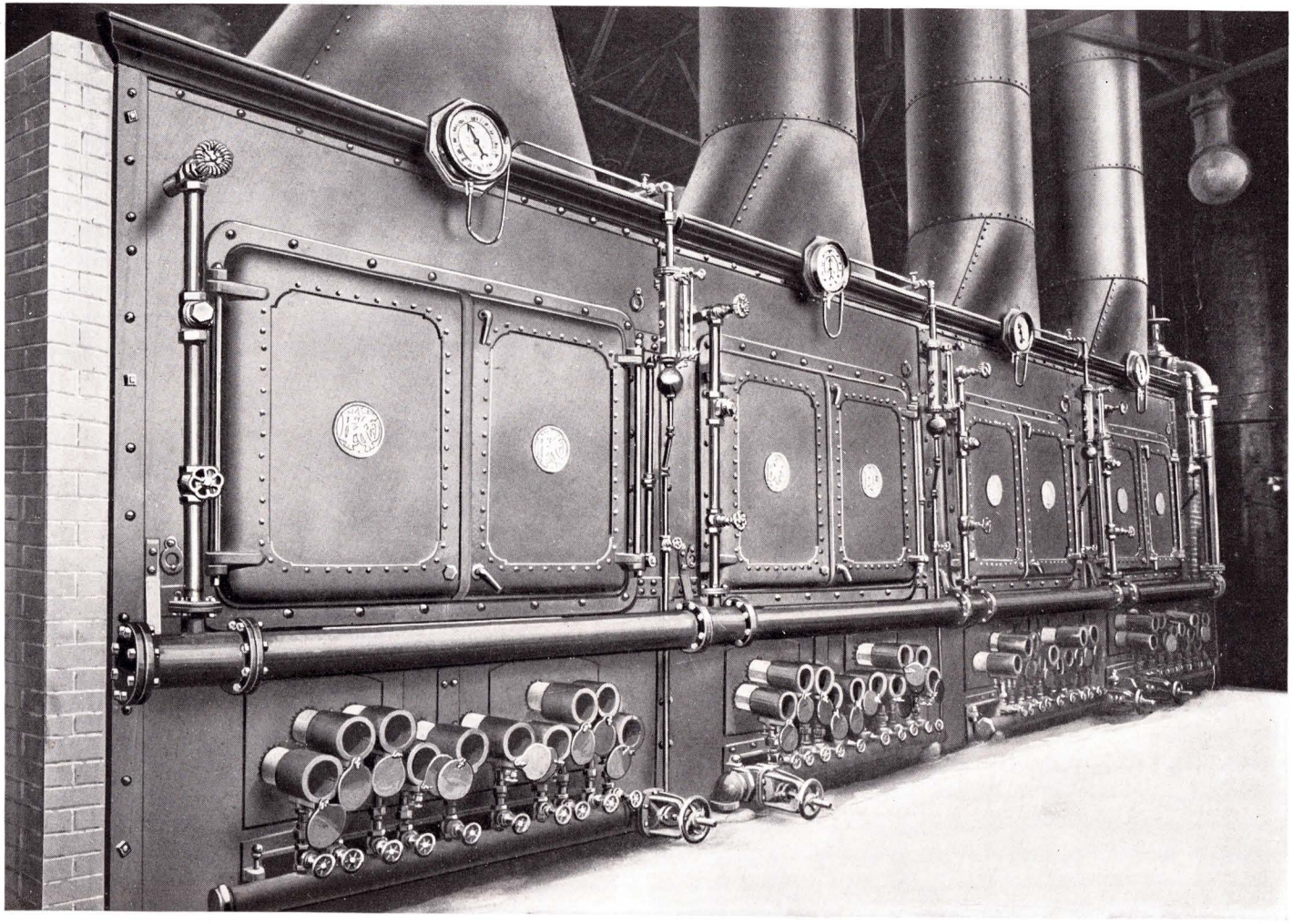
The operation of a fire door with this locking device does not require any more movement than required to open a fire door without this safety appliance.

It is a positive lock against any pressure from within the furnace.

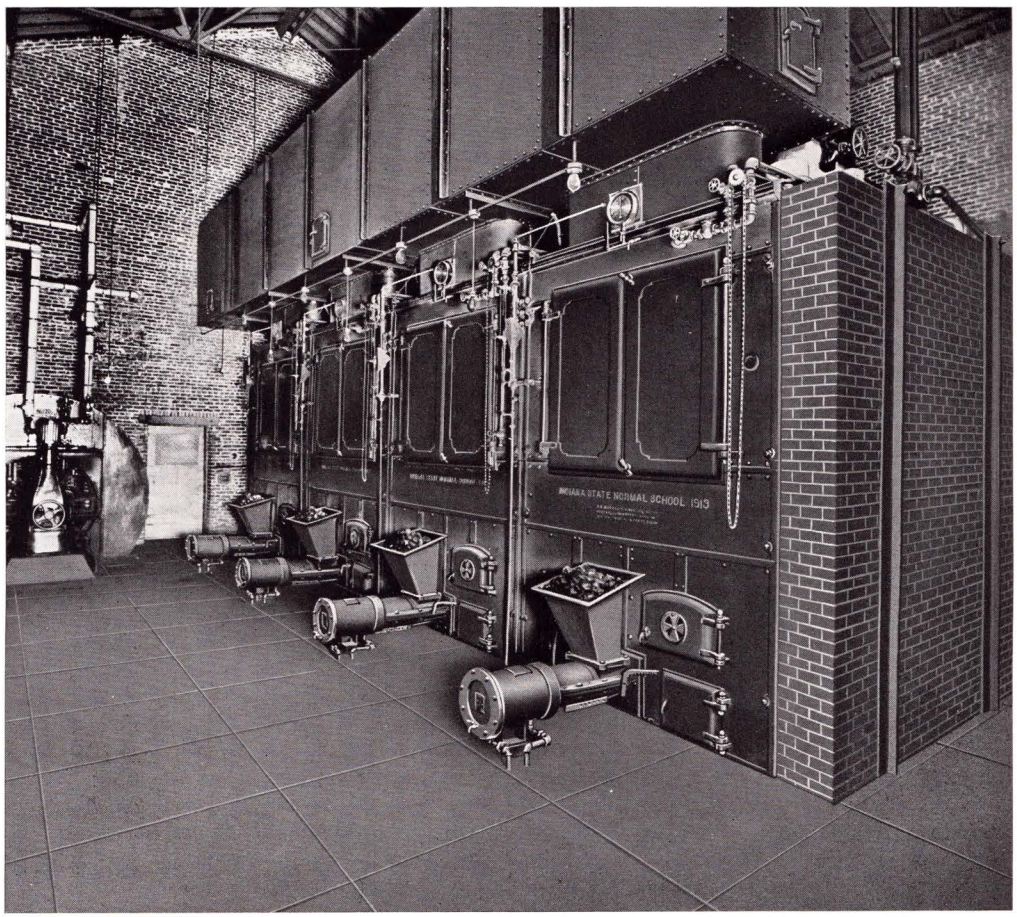
Locks for Clean Out and Ash Pit Doors also furnished.



FOUR 78″ x 20′ RETURN TUBULAR BOILERS
EQUIPPED WITH TRAVELING CHAIN GRATE TYPE OF STOKERS



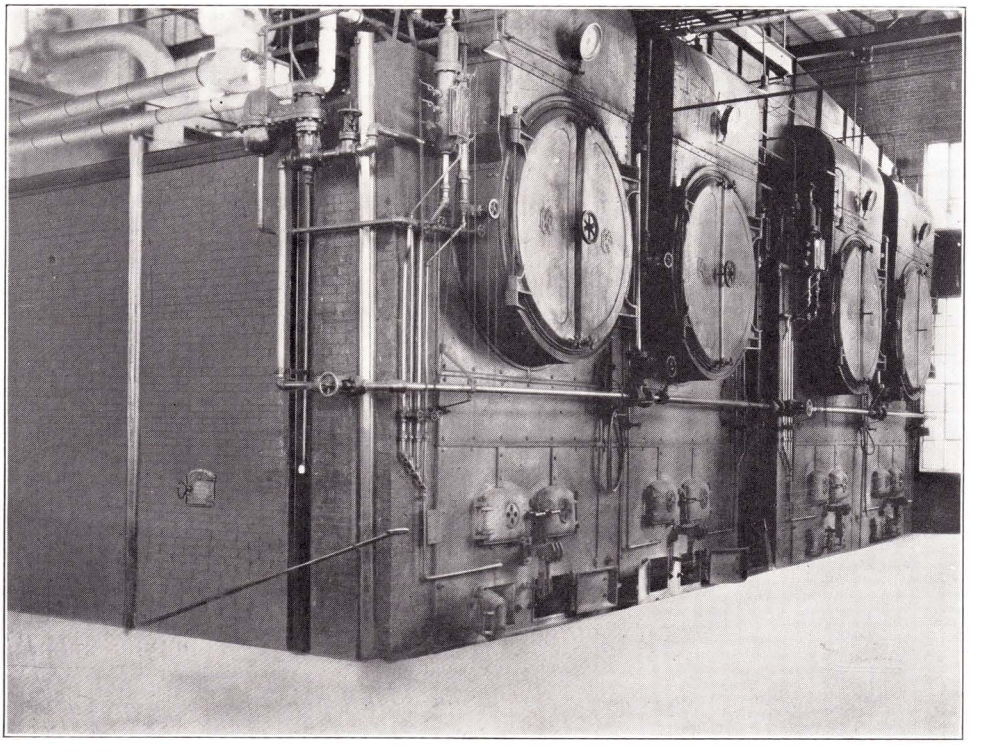
WEST VIRGINIA PULP AND PAPER COMPANY, PIEDMONT, W. VA., FOUR 84″ x 18′ RETURN TUBULAR BOILERS
SPECIAL STEEL FRONTS, BOILERS EQUIPPED FOR NATURAL GAS



INDIANA STATE NORMAL SCHOOL, INDIANA, PA., FOUR 72″ x 15′ RETURN TUBULAR BOILERS, UNDERFEED STOKERS

In sixty-four years of industrial activity no report has reached us of the explosion of any boiler built in our shop.

Since the E. Keeler Company was established in 1864 the shop has never been shut down a single day for lack of orders. Therefore this shop is probably no less busy than the BUSIEST SHOP IN THE WORLD.



U. S. RUBBER CO., WILLIAMSPORT, PA.
FOUR 84″ x 20′ HORIZONTAL RETURN TUBULAR BOILERS
SMOKE BOX EXTENSION TYPE FRONT, SET 7′-6″ FLOOR TO UNDERSIDE OF BOILER SHELL

Keeler Standard Boiler Fronts are the full flush type, but Dutch Oven or Smoke Box extended types are furnished if requested.

Steel Casings For Tubular Boilers

We are prepared to furnish, correctly designed and substantially built, sheet steel casings for boilers with or without Dutch Ovens.

The advantages of such casings are several. Air leaks are avoided. Surplus air entering the setting through cracks in the brick wall cool the products of combustion and lower the efficiency.

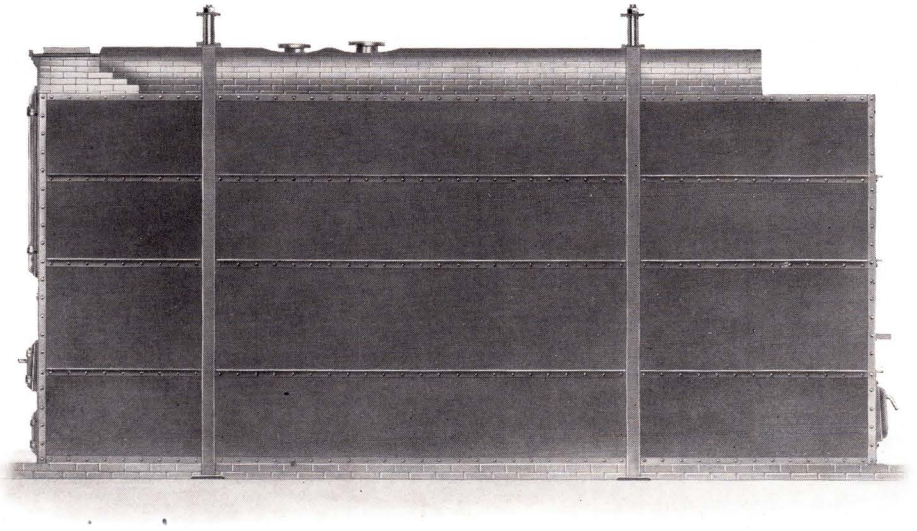
Steel casings are used advantageously where red or common brick is either high in price or poor in quality.

Where mason labor is high or where masons must be brought from a distance to take care of possible repairs, a casing may show a saving in first cost and a decided saving in upkeep.

Where there is a possibility that the plant may be moved in the course of a few years, the use of a steel casing is recommended to reduce the amount of foundations and masonry construction to a minimum, as the casing reduces the cost of setting both in the original and in the new location.

The erection of the casing presents no great difficulty, as each casing is set up complete in the shop and shipped in convenient sections, carefully marked, for erection.

Casings can be designed for 13 inch lining in the furnace, 9 inch lining elsewhere of fire brick and red brick or the lining of the casing may consist of magnesia blocks between the brick lining and the steel casing. This layer of insulating material very materially reduces the loss by radiation.

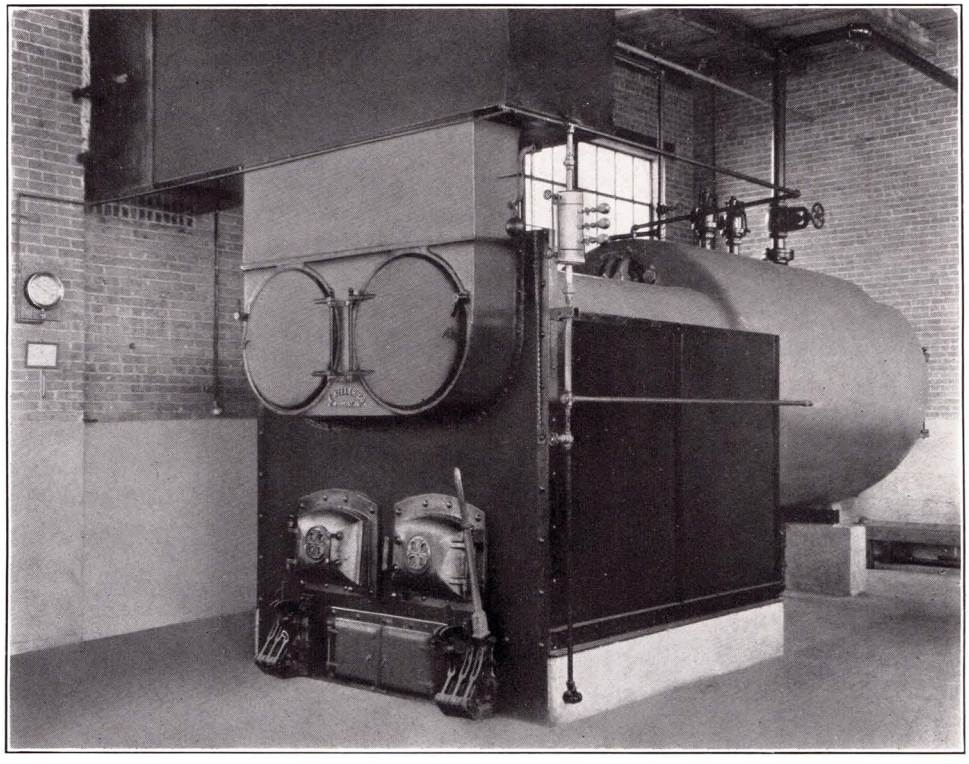


HORIZONTAL RETURN TUBULAR BOILER
IN STEEL CASING SETTING

Setting vs. Performance

Many purchasers of boilers have prepared elaborate plans for the architectural beauty of their power house and yet give little thought to the relation of boiler setting to operating efficiency.

The designing of boiler settings should be based upon fuel available and to steam demands. Without proper consideration of proportions only hit or miss results can be obtained. The E. Keeler Company maintain a staff of engineers to work out furnace and setting details so that Keeler Boilers give the maximum efficiency.



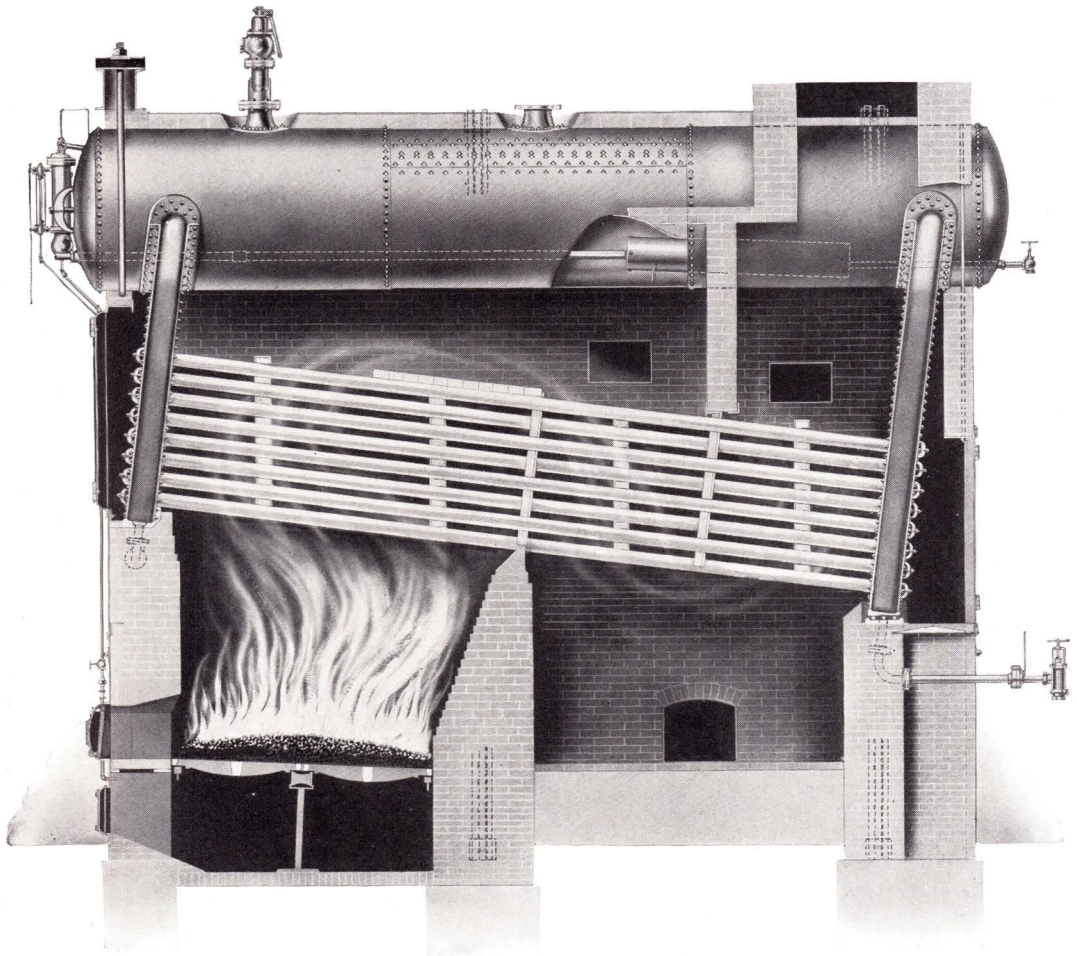
The Keeler Double Duty Boiler

The Keeler Double Duty Boiler is an all steel boiler built to withstand working pressure up to 125 pounds. It is built in units from 35 H. P. up to and including 170 H. P.

It is semi-self contained, possessing many advantages for operating efficiently and low cost maintenance not found in other types of self contained boilers.

There are no flat sides or crown sheets to stay, no pockets or water legs to collect scale or other foreign deposits. Facilities for cleaning and inspection are favorably placed so as to observe every part of the boiler.

Safety, Economy, Durability, Easy Cleaning, Quick Installation, Minimum Brick Work, Large Furnace Volume, Low Head Room, and Adaptability are some of the features described in a *catalog entitled "Double Duty Boiler."* It will be mailed *free upon request.*

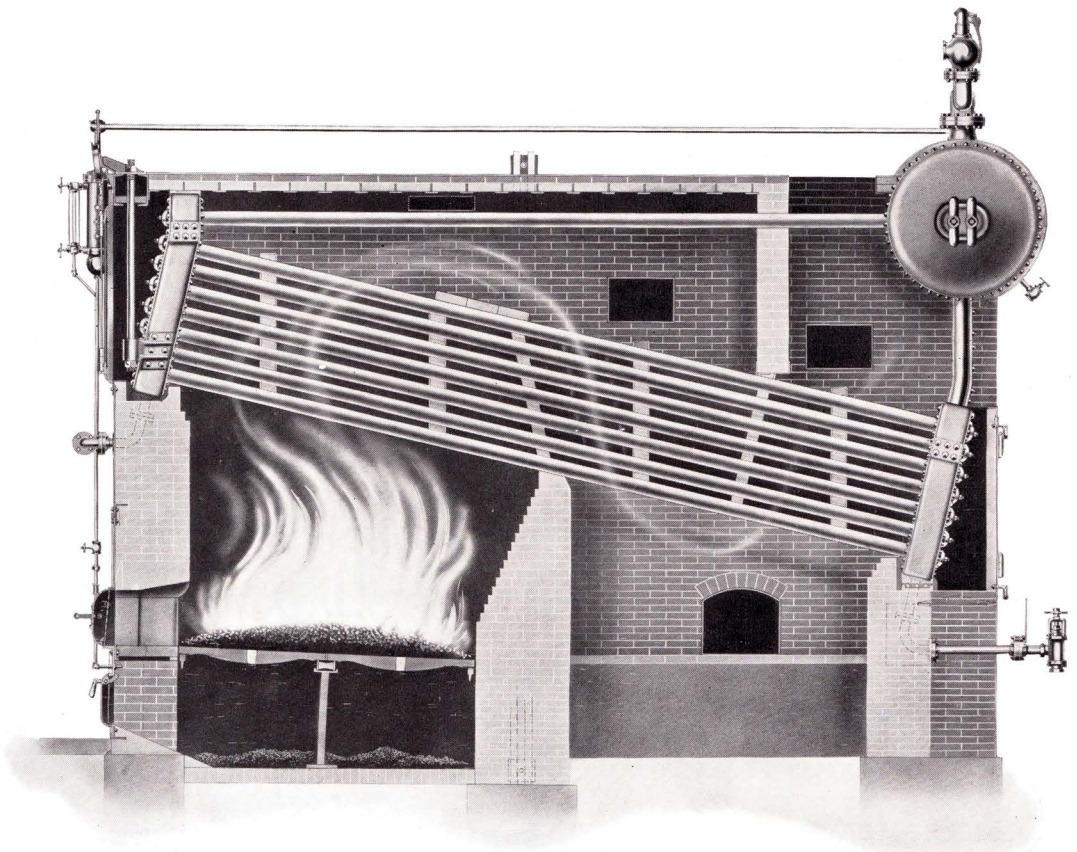


General Description—The Keeler Water Tube Boiler presents an unusually complete combination of features that have been widely recognized as valuable. This boiler was designed to secure simplicity and durability of construction together with absolute safety and the highest attainable economy.

The general arrangement follows well tried lines of practice. The boiler consists of one or more steam and water drums to which are securely riveted a front and rear water leg or header. The tubes are expanded into these headers in straight horizontal and staggered vertical rows with an inclination of one inch to the foot. The drum is horizontal, providing a maximum steam disengaging surface. The steam outlet is placed in the center of the drum.

Vertical baffle walls of a special grade of interlocking absolutely gas tight fire brick direct the gases three times through the bank of tubes. The tubes are staggered and the gases move at right angles to them. They are thus continually divided and reunited and brought into intimate contact with the tube surfaces. With vertical baffles special side cleaning doors are provided with separate openings opposite each space between tubes, preventing the admission of cold air when the soot blower is inserted.

Horizontal baffles can be provided if required by special conditions of fuel or service. Other special arrangements of baffle walls are offered when it is desired to take the gases from the bottom of the setting at the rear.



The Keeler Cross Drum Water Tube Boiler is a modification of the standard design only in the length and location of the drum and the method of connecting it to the headers.

This type was developed to meet the demand for a high grade water tube boiler that could be installed in Office Buildings, School Houses, Churches, Apartment Houses, Hotels, and boiler rooms generally where ceiling height is limited or where the boiler must be introduced through narrow passageways or restricted openings.

The pressure parts of the boiler are shipped in a knocked down condition, making it possible to install it without cutting through walls and floors in locations that would be wholly inaccessible for almost any other type of boiler.

If boilers are to be exported, the cross drum boiler can be handled at much less expense by steamship companies on account of its reduced bulk in a knocked down condition, and the comparatively small weight of the heaviest piece. If boilers must be hauled to destination over difficult roads or over bridges of limited capacity this boiler meets all requirements.

The drums and headers are thoroughly tested under hydrostatic pressure before shipment. There are no rivets to be driven in the field, all joints being made by expanding tubes into accurately drilled holes.

While the Cross Drum Boiler may be erected by any mechanic familiar with water tube work, we are prepared to send erecting engineers, of large experience, with this boiler to any part of the country.

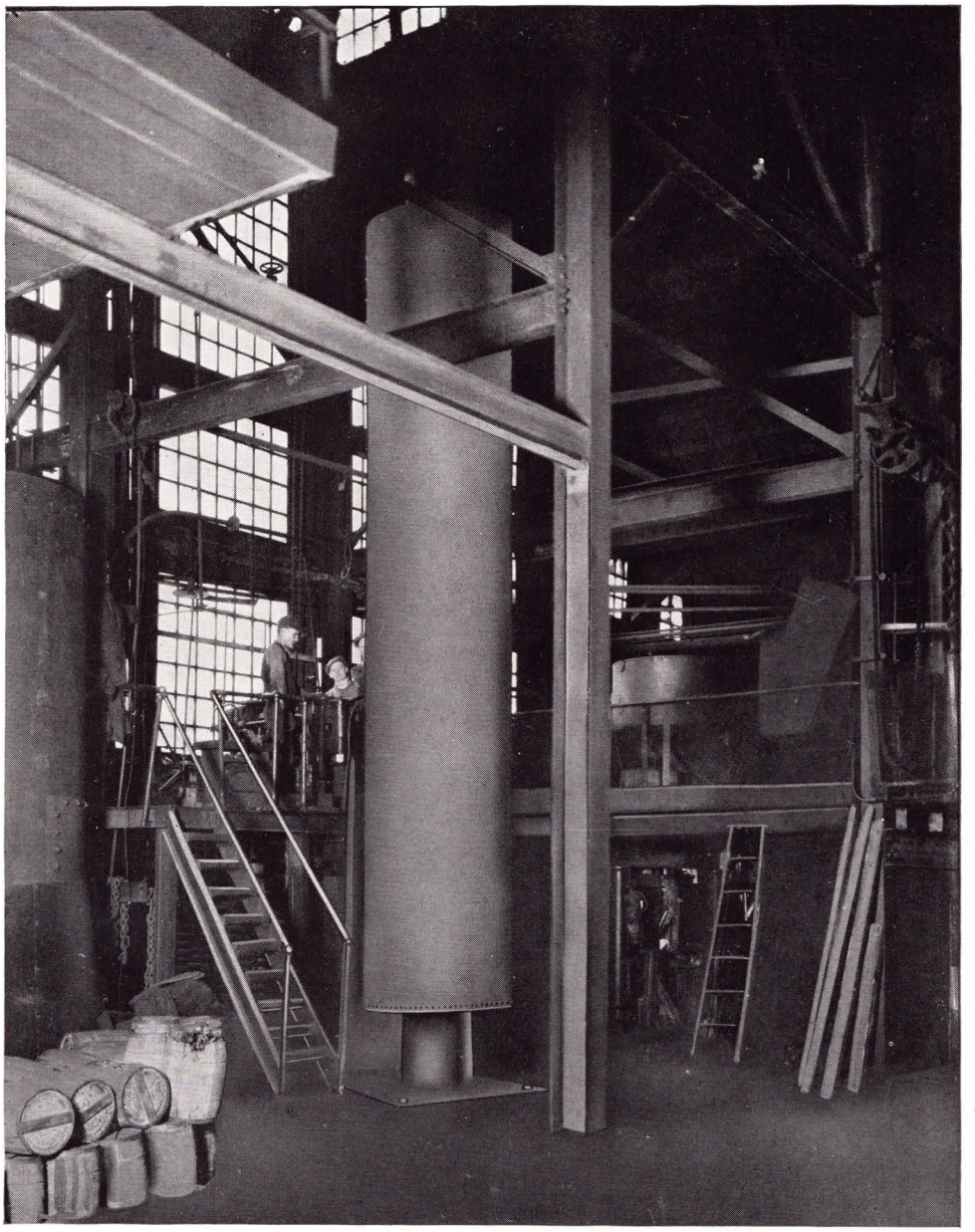
A full description of this boiler will be found in our book "Water Tube Boilers" which will be sent on request.

Stacks

Water Tube Boilers		Horizontal Return Tubular		Double Duty Boilers		
H. P.	Stack Dia. Height	Boiler	Stack Dia. Height	Size	Stack for Heating	Stack for Power
79—115	30″ x 90′	44″ x 14′	24″ x 50′	35 H. P.	22″ x 55′	22″ x 70′
126—134	34″ x 90′	48″ x 12′	24″ x 50′	40 H. P.	22″ x 55′	22″ x 75′
150—164	36″ x 90′	48″ x 14′	26″ x 40′	50 H. P.	24″ x 55′	24″ x 75′
179—193	38″ x 100′	54″ x 14′	28″ x 50′	60 H. P.	26″ x 55′	26″ x 70′
207—235	42″ x 100′	54″ x 16′	28″ x 50′	70 H. P.	26″ x 60′	26″ x 75′
250—266	45″ x 100′	60″ x 14′	28″ x 55′	85 H. P.	28″ x 65′	28″ x 75′
281—	48″ x 100′	60″ x 16′	28″ x 60′	105 H. P.	30″ x 65′	30″ x 75′
300—338	48″ x 110′	60″ x 18′	30″ x 60′	130 H. P.	32″ x 65′	32″ x 75′
353—	51″ x 110′	66″ x 16′	30″ x 60′	150 H. P.	34″ x 65′	34″ x 75′
373—	51″ x 125′	66″ x 18′	34″ x 60′	170 H. P.	36″ x 65′	36″ x 75′
408—454	54″ x 125′	72″ x 18′	34″ x 60′			
476—500	57″ x 125′	72″ x 20′	38″ x 70′			
547—603	60″ x 125′	78″ x 18′	38″ x 70′			
653—	60″ x 150′	78″ x 20′	38″ x 75′			
697—	66″ x 125′	84″ x 18′	42″ x 75′			
756—796	66″ x 150′	84″ x 20′	42″ x 75′			

Many engineering hand books contain formulas for figuring stack dimensions. Many of them publish tables giving diameters and height of stack for various horse powers. Few of such publications have taken into consideration the fact that there is a difference in draught losses for different design and types of boilers; a difference in requirements for different class and grade of fuels and operating conditions.

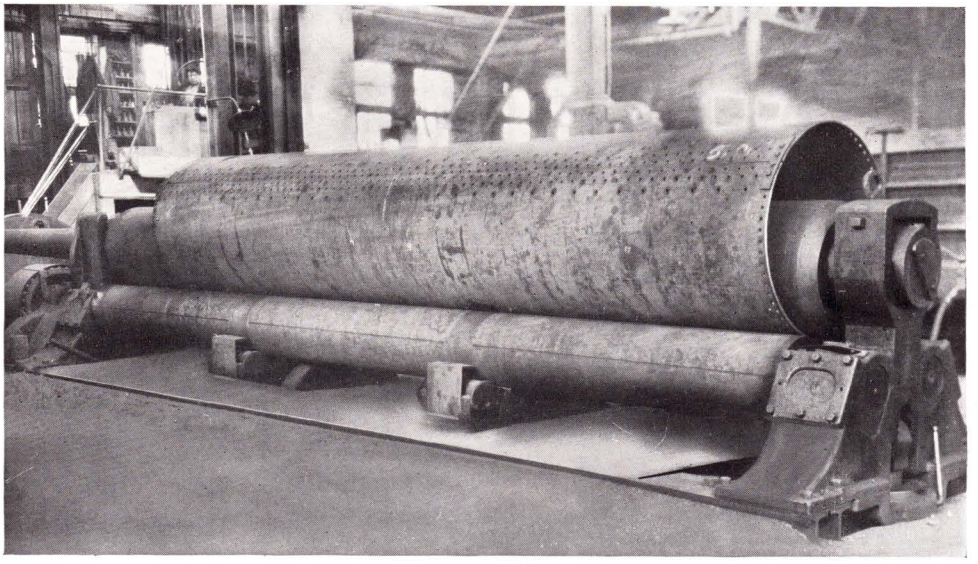
The above tables have been carefully worked out by E. Keeler Company engineers for the types of boilers specified, based on conditions of operation and fuel most generally used.



It is generally conceded that the secret of successful riveting is: First, proper preparation of the holes. Second, heating the rivets to a correct temperature. Third, exerting sufficient pressure on the rivet. Fourth, to hold the pressure until the rivets are cold and shrinkage has taken place.

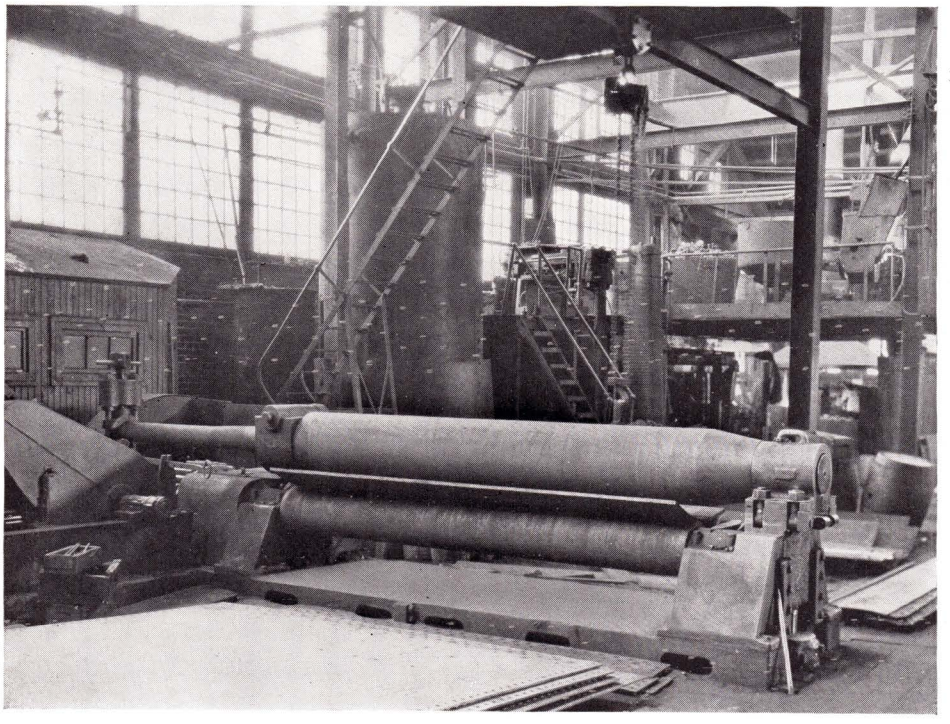
Keeler Hydraulic Riveting Machines exert a constant pressure. This pressure is varied to suit the diameter of the rivets being driven, and can be regulated to a maximum of 150 tons per square inch.

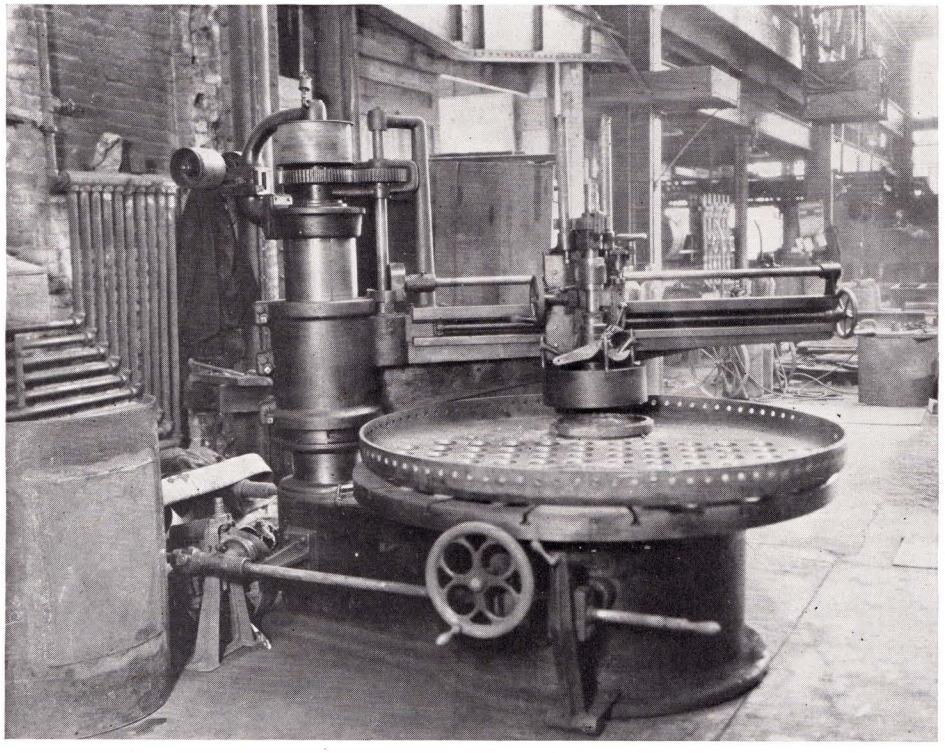
Boiler Makers, Mechanics, and Laborers employed in building Keeler Boilers are paid by the hour and not by "piecework." "Piecework" pay is an incentive to speedy—often inferior work.



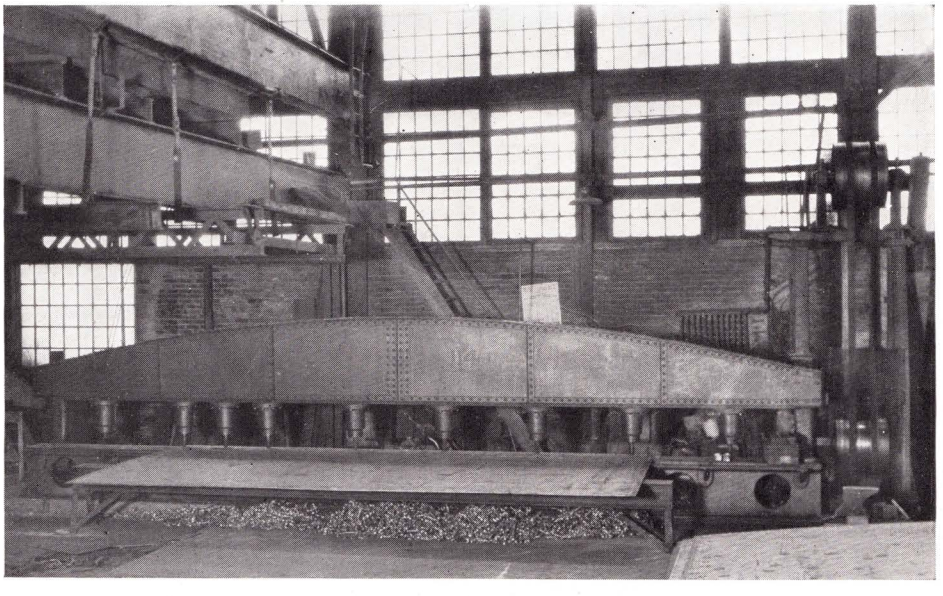
The sets of Pyramid Rolls illustrated above show a comparison between the ordinary boiler shop equipment and that to be found in the Keeler Shops. The above set measures 44 ft. 6 in. over all and will roll a sheet of steel plate 26 ft. in length and two inches thick. The top or adjustable roll weighs 43 tons. Each of the two smaller rolls which make up the set weigh 22 tons.

The Rolls illustrated below will accommodate the bending of a sheet 10 ft. 6 in. long. This machine measures only 21 ft. 7 in. in length. It is the type usually found in boiler plants.

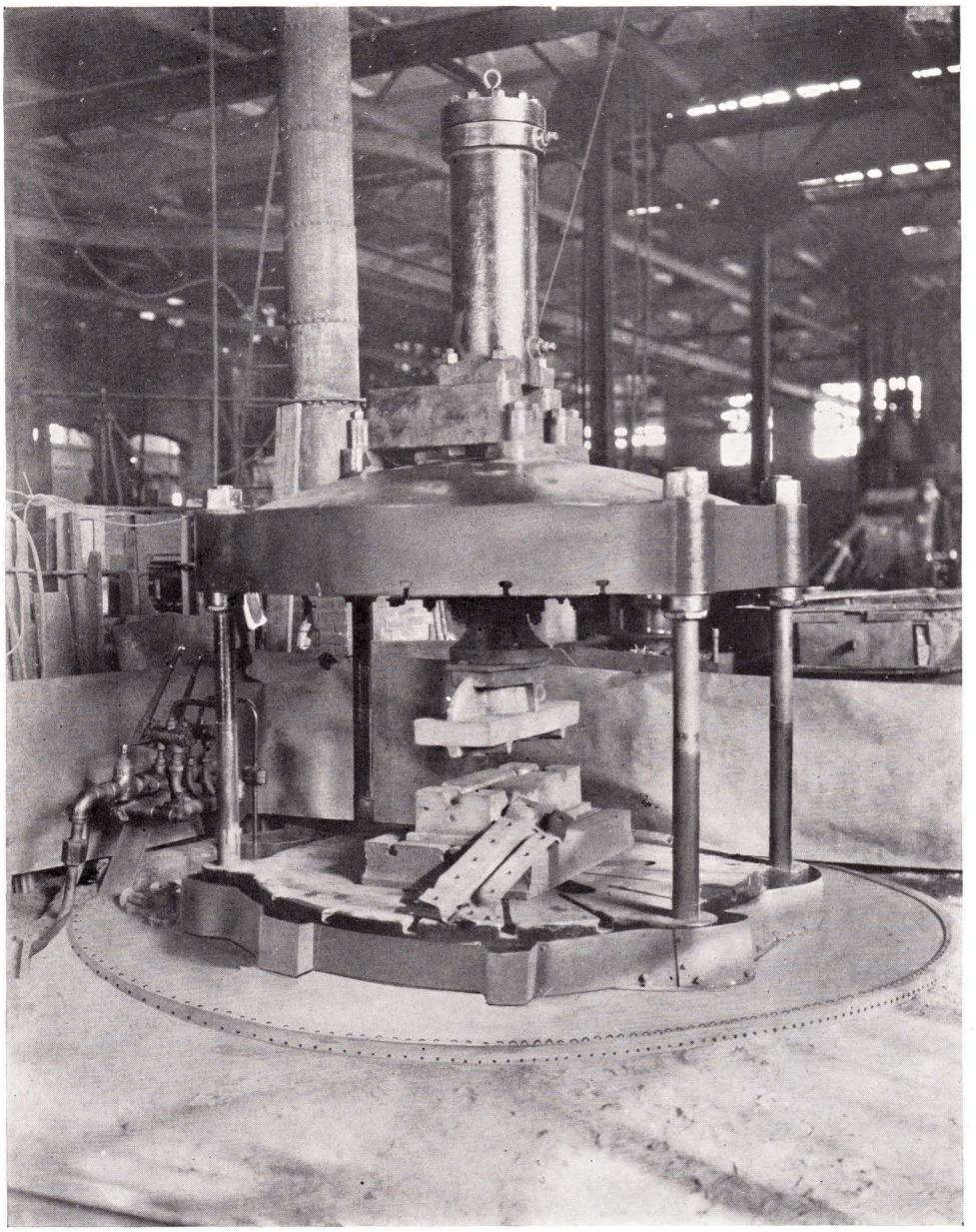




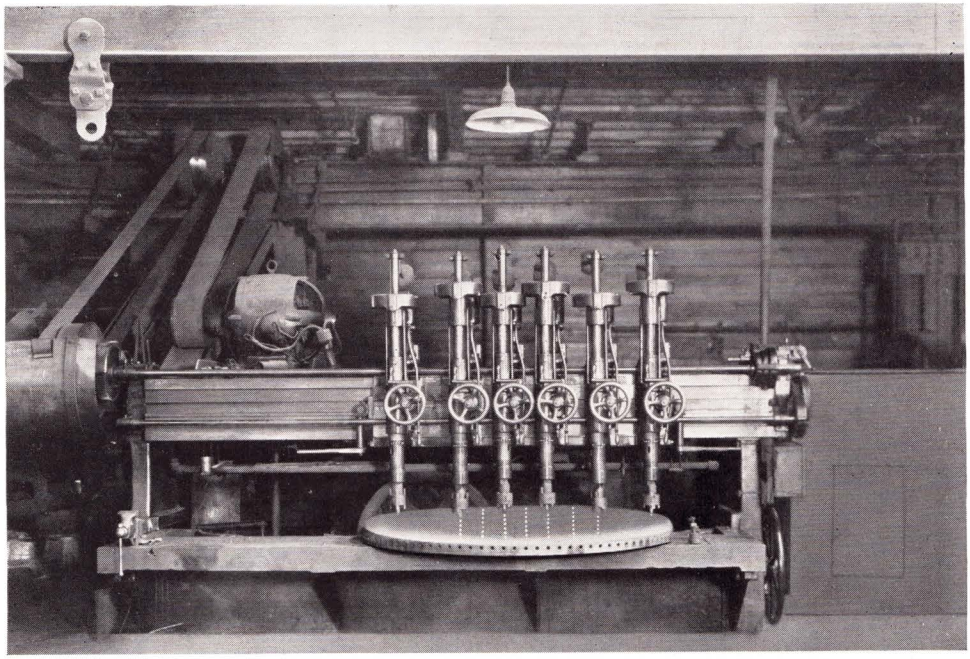
GRINDER USED FOR FACING CASTINGS, ETC.



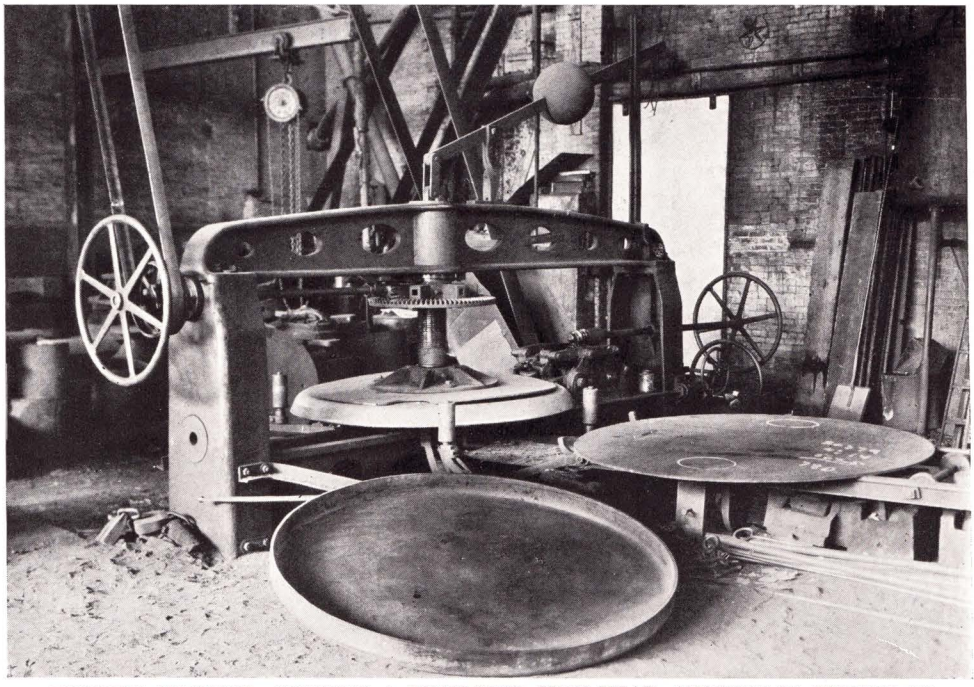
All plates are planed to an angle of 15 degrees for caulking. This machine is capable of planing a steel plate 30 feet long without resetting. Cutting tools are arranged on a traveling carriage so as to operate in both directions along the sheet.



Each part of Keeler Boilers is fabricated in the Keeler Shops. The flange shop is equipped with flanging machines which perform their duty at one constant pressure of 250,000 pounds. All flanging is done at a single heat.



LARGE MULTIPLE DRILLS ARE USED TO MAKE THE TUBE HOLES



SPINNING MACHINE. SHOWING A COMPLETED SPUN HEAD. ANOTHER IN PROCESS OF SPINNING AND A CIRCULAR PLATE ON TRUCK WHICH LEADS FROM THE ANNEALING FURNACE TO SPINNER

The heads for all Keeler Return Tubular Boilers are flanged on a Spinning Machine which turns the plate to an angle of 90 degrees without thinning the metal at the flange as occurs when the pressure flanging method is used to form boiler heads.

GRIT PUBLISHING COMPANY
WILLIAMSPORT, PA.